



Decline Curves

Joint House Resources and Energy Committees

23 April 2012

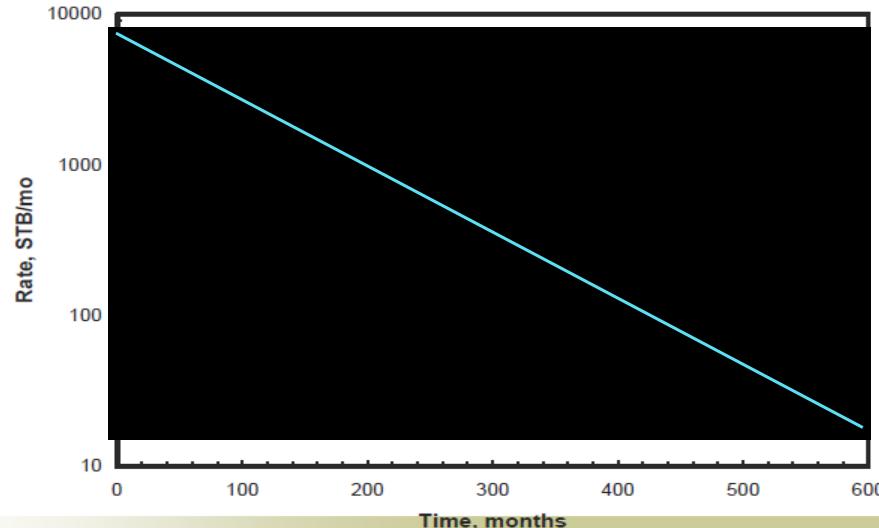
William C. Barron

Division of Oil and Gas





Decline Curve Shapes: Semilog Rate-Time



- Exponential $b=0, q_t=q_i \exp^{(-Dt)}$
- Hyperbolic decline $b>1 : q_t=q_i / (1+bD_i t)^{(-1/b)}$
- Harmonic Decline where $b=1, q_t=q_i / (1+D_i t)$

Where: t = time of interest, q_t = rate at time t , q_i =initial rate, D_i is decline rate at time 0 (1/time), b =Arps' decline constant describing curvature of simi-log rate vs. time





Items Affecting Production

Adding Production

- Well Drilling
- Well Maintenance
- Enhanced Oil Recovery
- New Facilities, Infrastructure, Debottlenecking
- New Technology

Decreasing Production

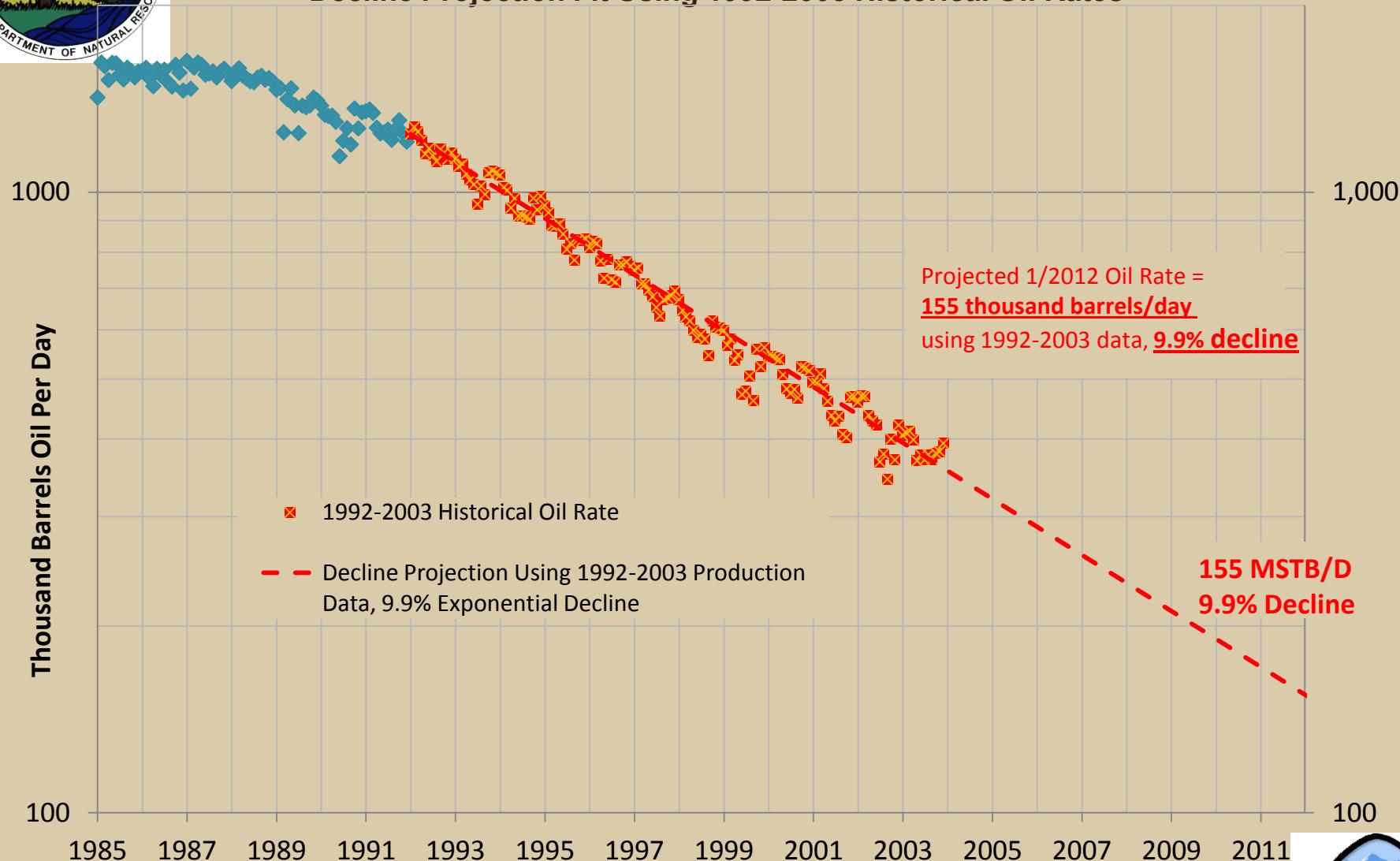
- Aging facilities and infrastructure
- Gas and Water Handling
- Well Failures
- Decreasing new well rate with time
- Costs





PBU Initial Participating Area

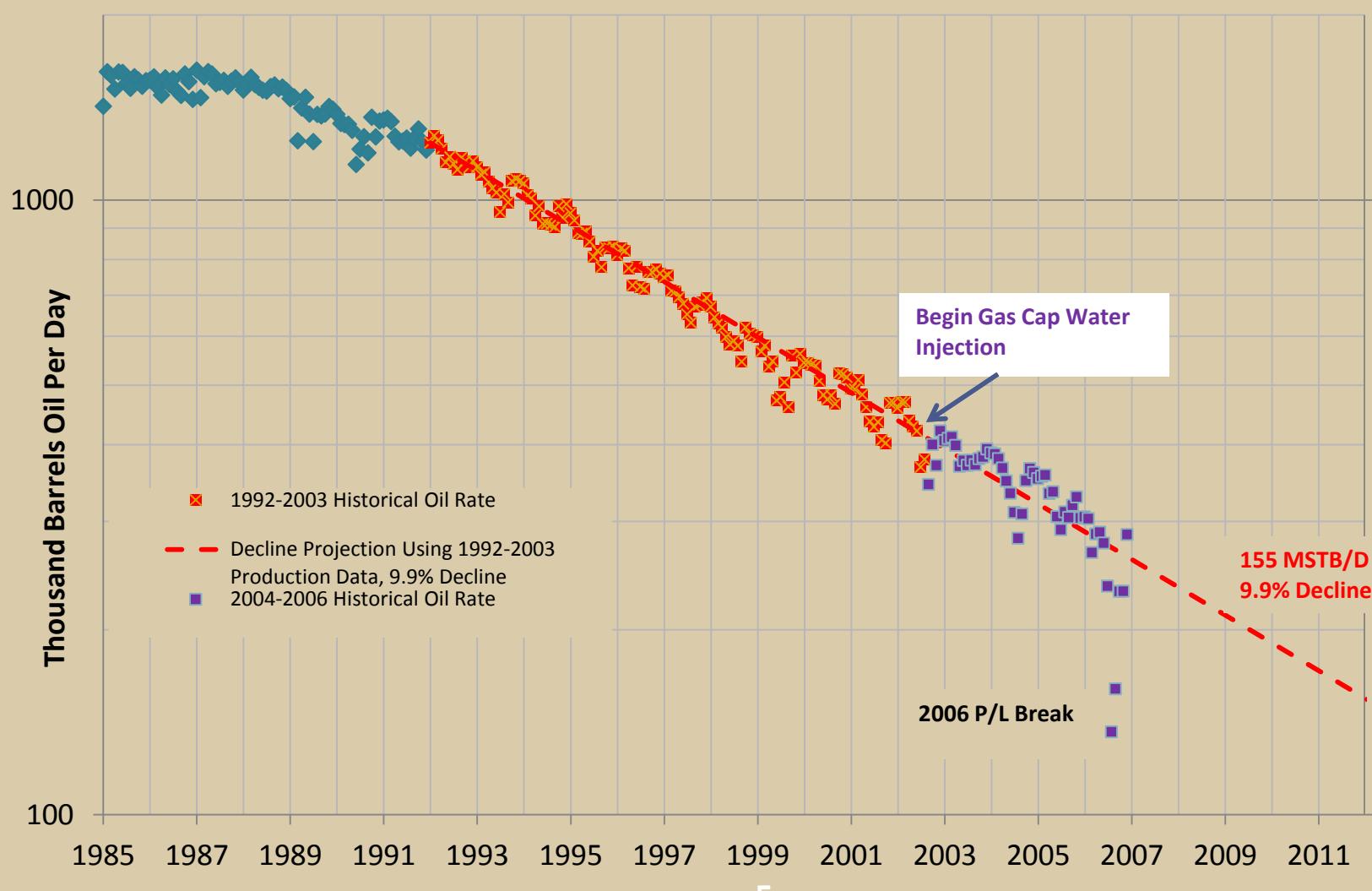
Decline Projection Fit Using 1992-2003 Historical Oil Rates





PBU Initial Participating Area

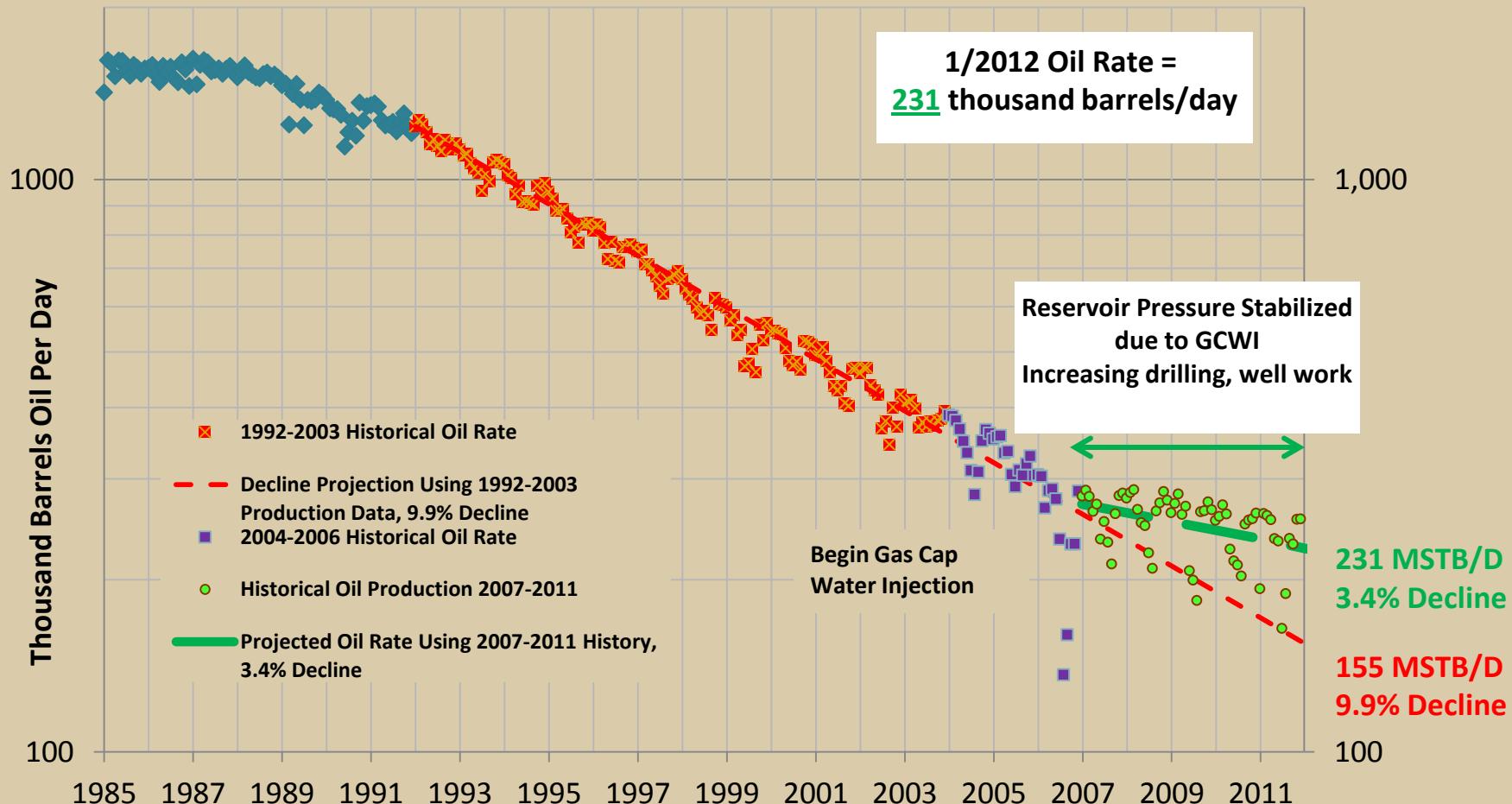
PBU Initial Participating Area
Decline Projection Fit Using 1992-2003 Historical Oil Rates
Gas Cap Water Injection Begins 2002





PBU Initial Participating Area

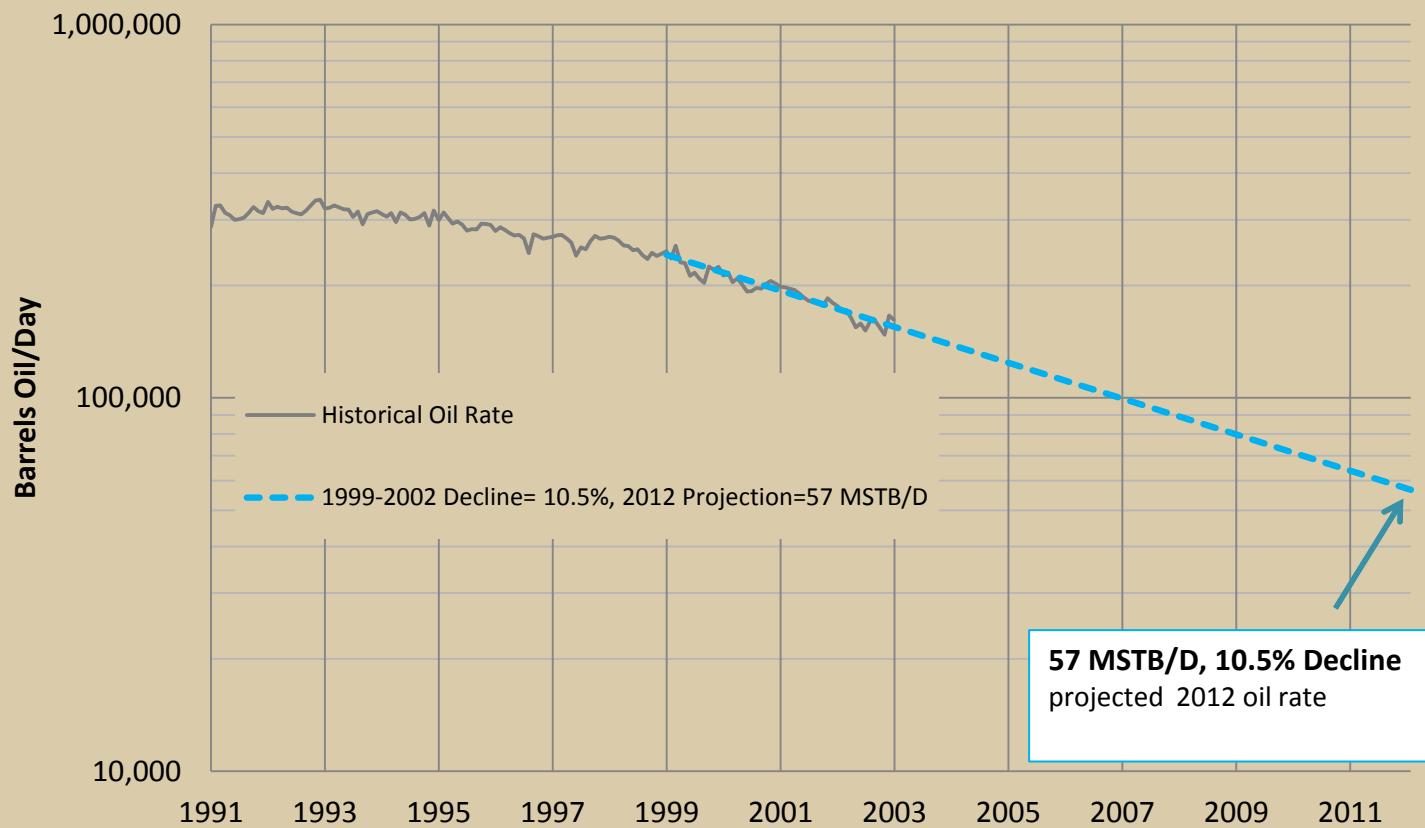
Decline Projection Using 2007-2011 Data
Effect of Gas Cap Water Injection, Drilling, Well Work
Oil Rate increase of +/- 75 thousand barrels/day





Kuparuk River Unit - Kuparuk Participating Area

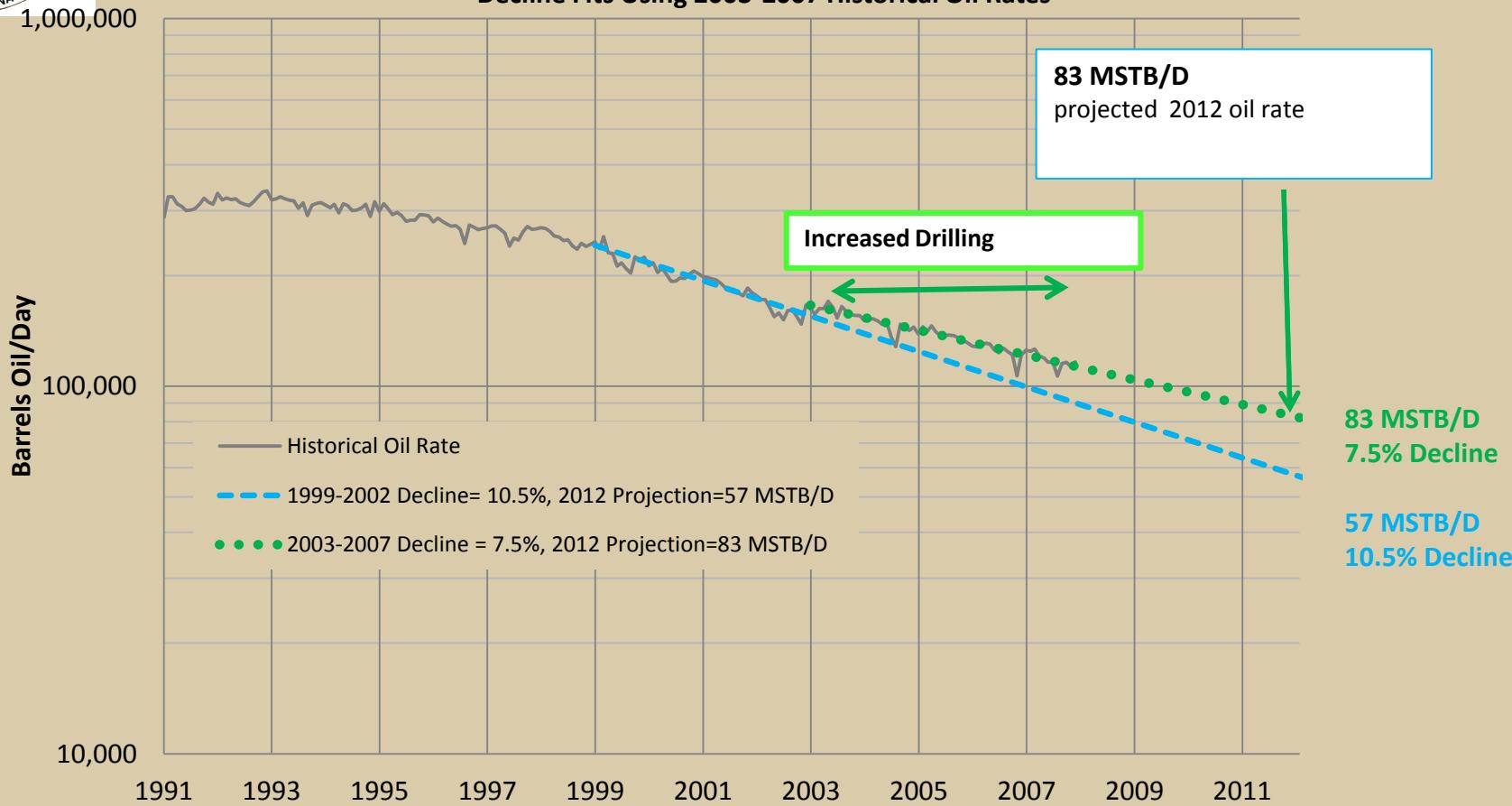
Decline Fits Using 1999-2002 Historical Oil Rates





Kuparuk River Unit - Kuparuk Participating Area

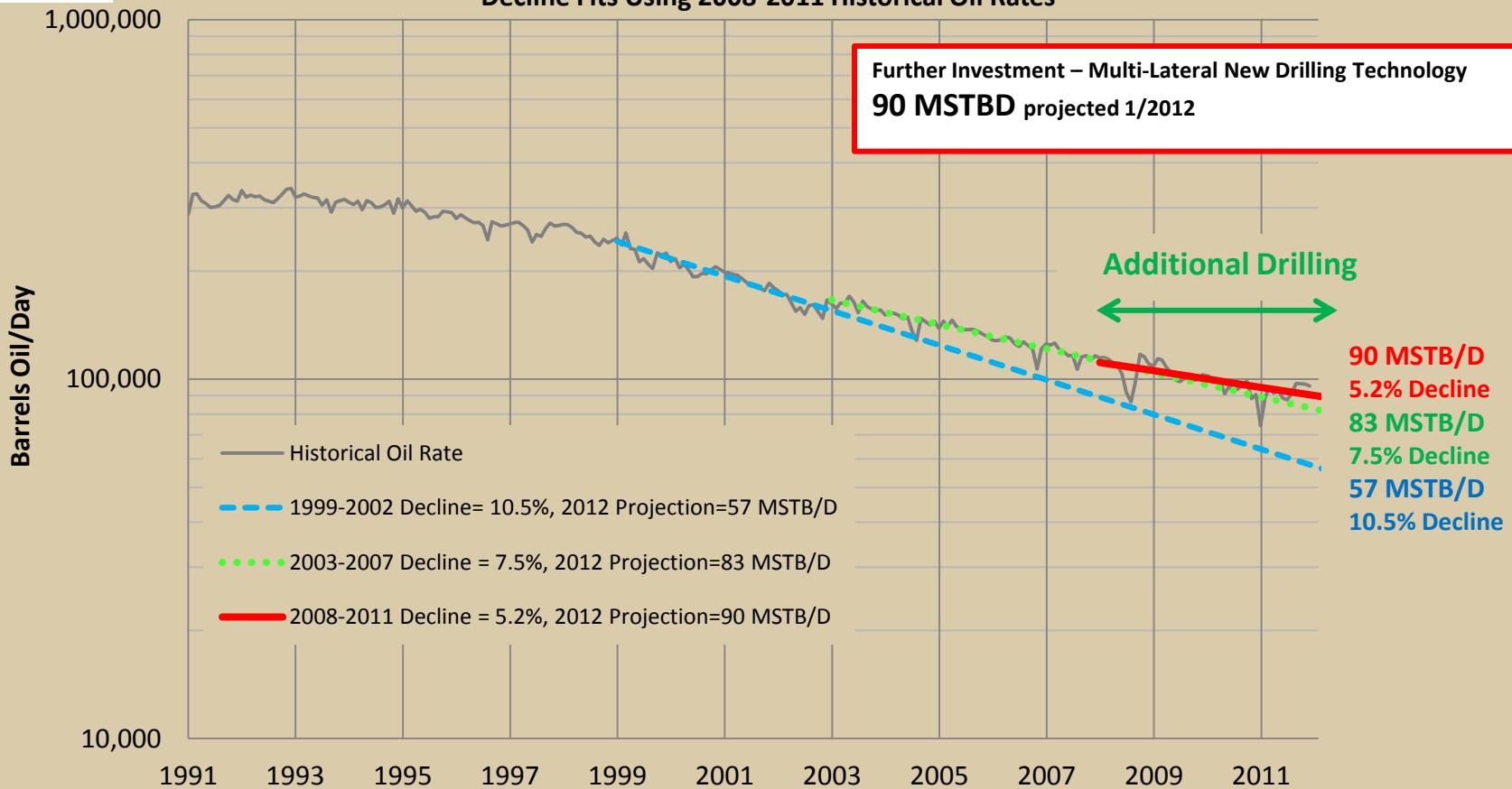
Decline Fits Using 2003-2007 Historical Oil Rates





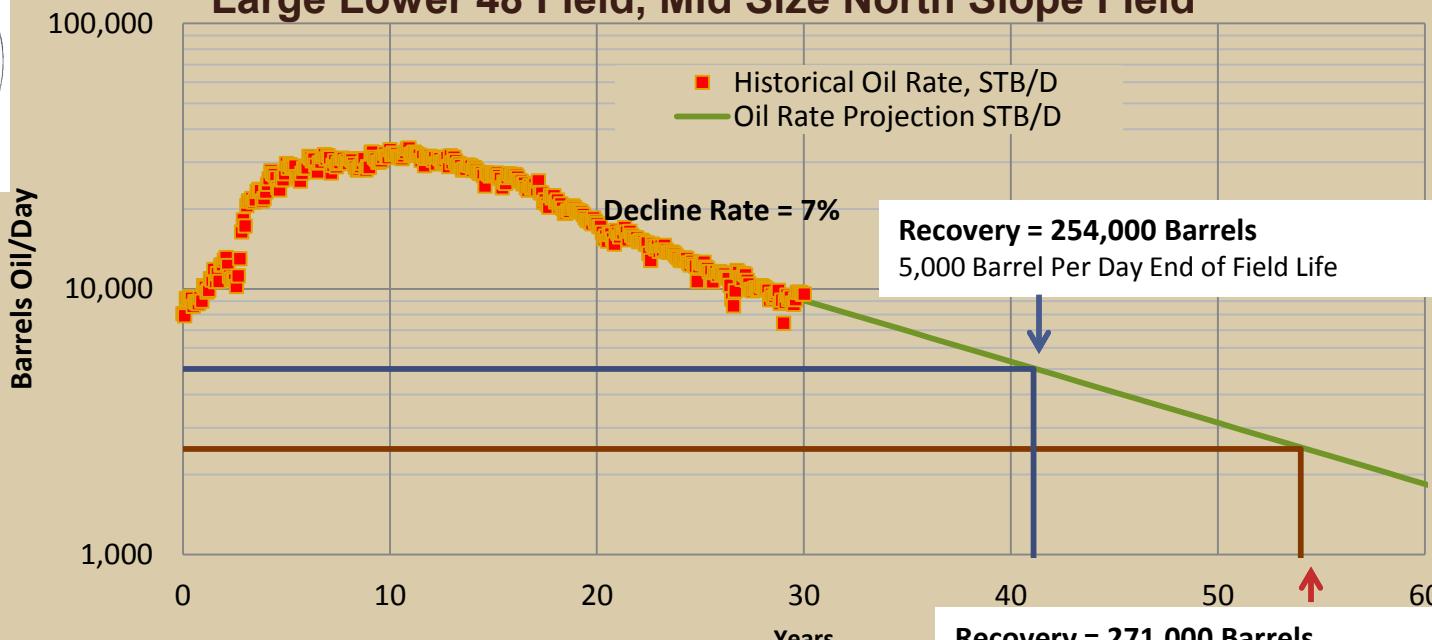
Kuparuk River Unit - Kuparuk Participating Area

Decline Fits Using 2008-2011 Historical Oil Rates

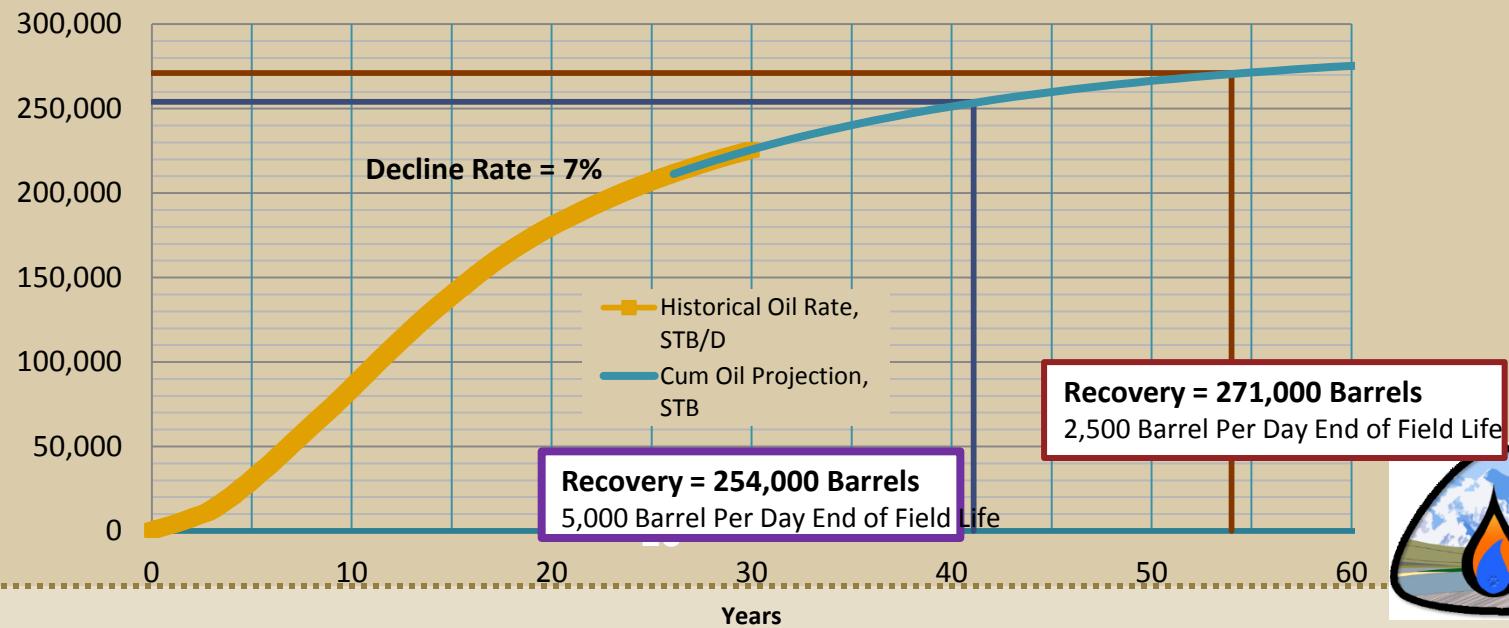


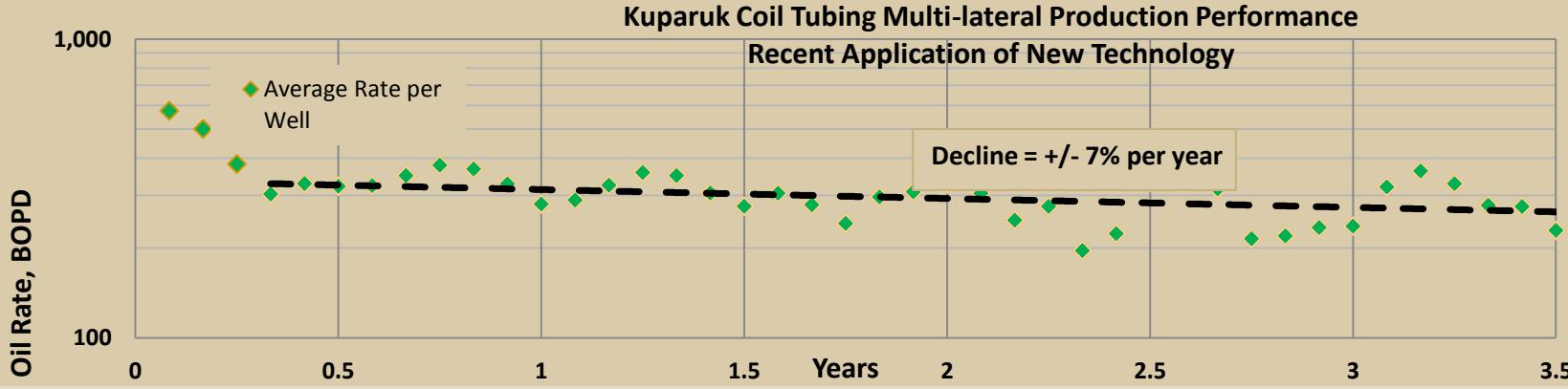
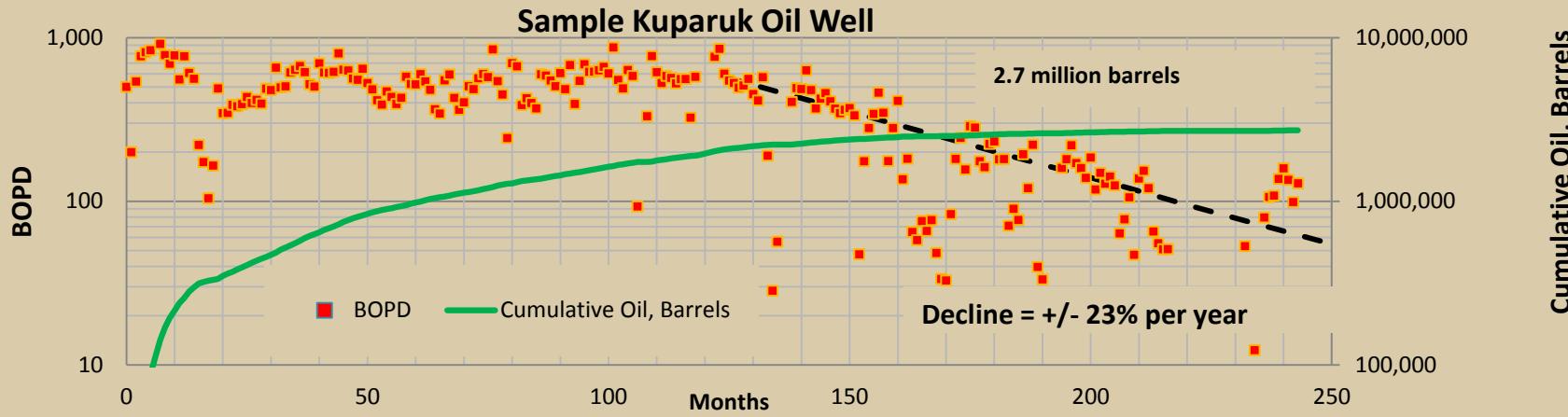
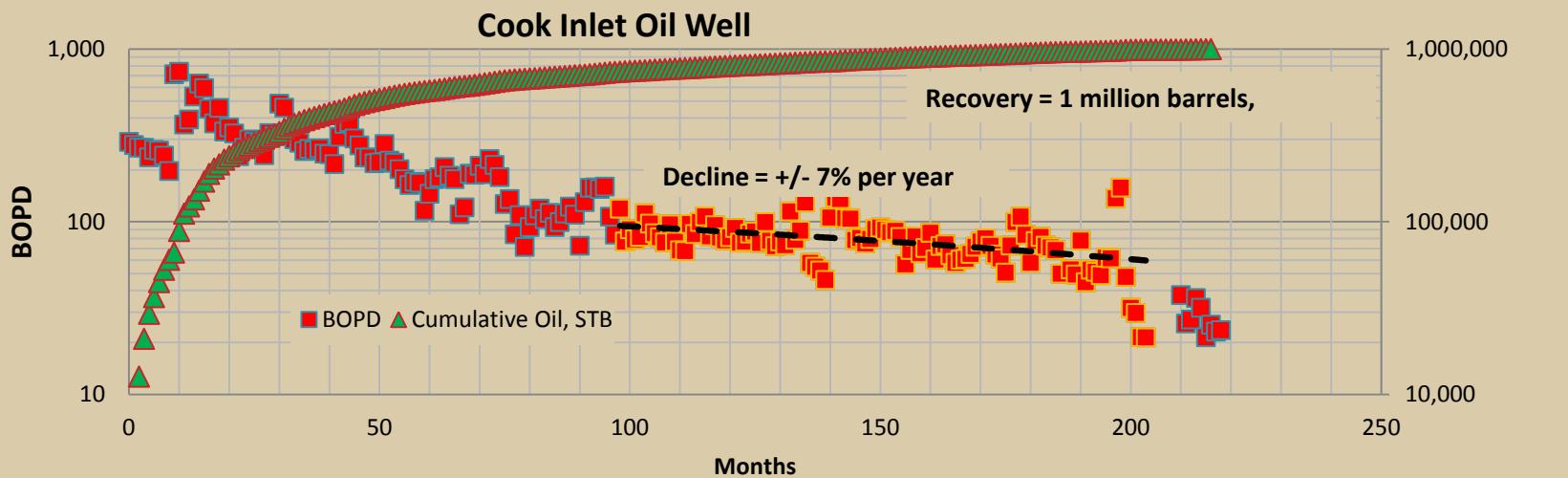


Large Lower 48 Field, Mid Size North Slope Field



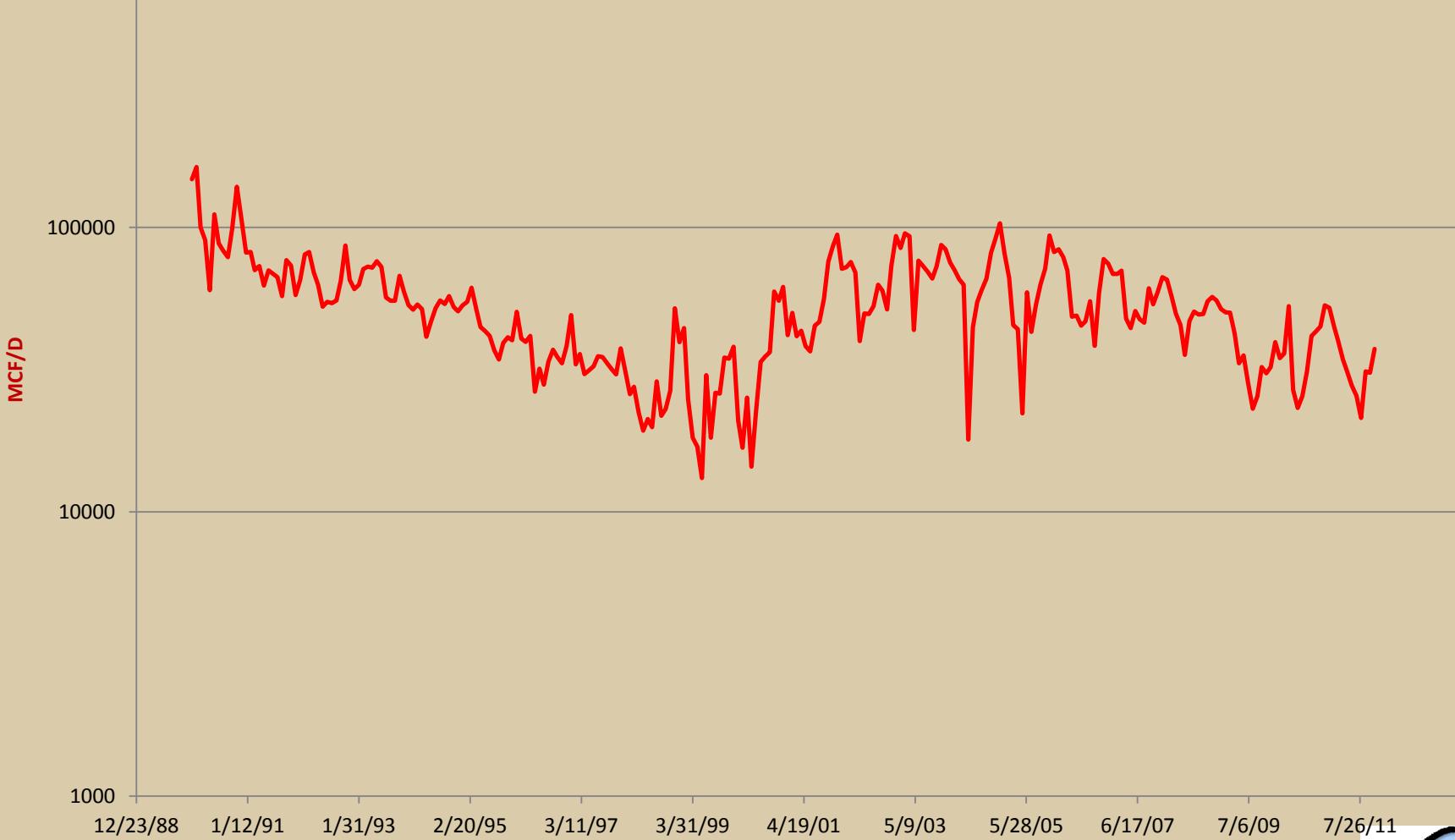
Cumulative Oil, Barrels



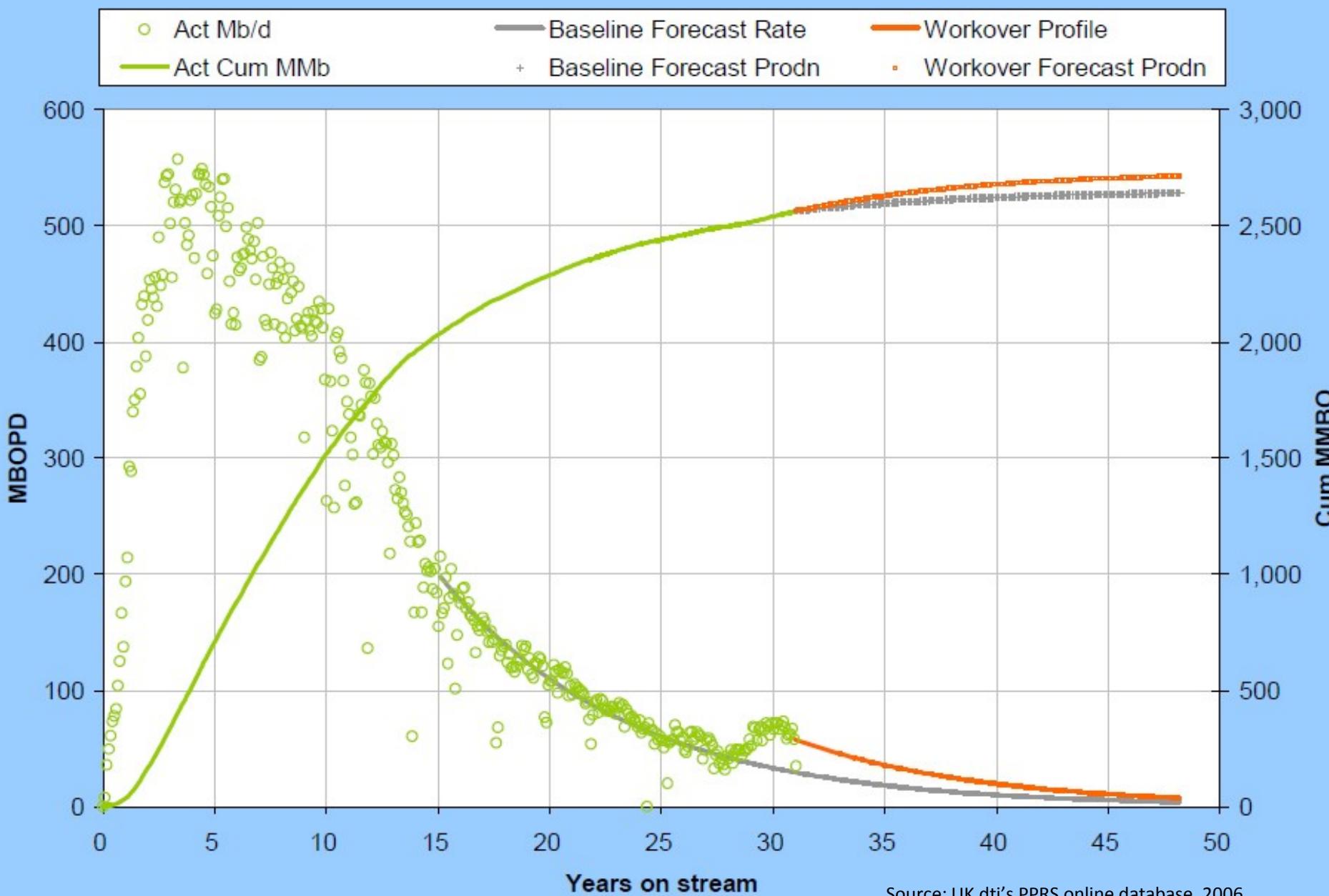




Kenai Gas Field Daily Gas Production in mcf/d



Forties Field, North Sea, production



Source: UK dti's PPRS online database, 2006



What will it take to reach the goal?

- Collaborative and competitive environment
- Minimize all barriers
- Access all fields and all types of oil

